Fitments

Background of the Invention

The present invention relates to closures for aseptic and extended shelf life (ESL) containers and more particularly paperboard cartons.

In non-aseptic containers it is well known to use carton fitments that extend through a wall of a paperboard carton. These fitments are constructed to provide a pour spout and provide a resealable closure such as a threaded spout and overcap. They are typically made of injection-moulded plastics. The fitment may also provide tamper evidence such as a severable tamper band connecting a lower edge of the overcap to a body of the fitment. Ring pull removable membranes are often provided within the spout. A typical fitment will have a base flange and a cylindrical spout.

Such fitments are inserted, as fully assembled components with an overcap fitted, through a hole cut in the top of the carton. The fitment is passed through the hole from the inside of the open top during the filling process. The base flange, being larger than the diameter of the hole, remains inside the carton. Ultrasound welding is used to weld the base flange to the carton and secure the fitment in place. Fitments of this type are used extensively to enable gable top paperboard cartons to be resealable. They are typically used for fresh milk and fresh juice, which are not packed aseptically.

Aseptic packaging

In aseptic filling a UHT process is used to process the product prior to filling. The product is subjected to high temperature (140°C) for a very short period (4 seconds) and then cooled to a temperature between ambient and 4 degrees C. Once cooled the product must remain in sterile conditions and cannot be exposed to environmental air or bacteria. The cartons and fitments must also be cleaned and sterilised, typically using Hydrogen Peroxide or peracetic acid, which is later evaporated off the components. The cartons are then filled and sealed in an aseptic environment. The packaging must also be sealed tightly enough to prevent re-infection. This process is

effective to provide long shelf-life products. The cost of the filling plant is significant.

ESL packaging covers other processes such as microfiltering to ensure minimal microbe presence in the product.

A significant feature of both aseptic and ESL cartons is the presence of a continuous barrier layer. This layer is required to prevent bacteria, microbes, yeasts or fungal spores passing into the container and to provide a gas barrier. The use of existing carton fitments that require a pre-cut hole in the carton blank is clearly not possible.

Cartons for use in aseptic packaging are typically constructed of several layers. In one example there are seven layers that make up the aseptic package. From the outside in they are - polyethylene, adhesive, paper, adhesive, aluminium foil, adhesive and polyethylene. The aluminium foil provides a barrier layer. The adhesive layers serve to adhere the materials together and the polyethylene layers serve to provide surface coatings. These layered structures are described as composite paperboard. The barrier layer may alternatively be made of EVOH.

The original aseptic cartons were composite paperboard tetrahedrons and later bricks, which were difficult to open and could not be resealed. Aseptic cartons are now provided with carton fitments that offer reclosable, tamper-evident screw overcap closures as with paperboard cartons. In order to maintain the barrier layer, two methods have been employed.

In the first method a hole is cut in the outer paper and plastics layers of the composite paperboard blank before the blank is laminated with a barrier and inner layers. The fitment is then applied to the exterior of the carton and must incorporate a mechanism for cutting, tearing or punching through the barrier and inner layers. In the second method the composite paperboard is scored or weakened without penetrating the barrier layer at the position where the carton fitment is to be placed. The cutting, tearing or punching mechanism then has to break through all the layers of the composite paperboard. A great variety of designs have been proposed for this mechanism. These range from pivoting levers; ratchets that drive teeth down through

the paperboard, and punch thorough systems which require the user to push a thumb down into the spout. Examples of such post applied carton fitments are described in EP-A-1, 127 798 (Rexam), which teaches a cam driven mechanism; and WO 98/41452 (Tetra Laval), which teaches a ratchet mechanism and provides a tamper indicator. Numerous other post-applied fitments are available on the market from manufacturers such as SIG Combibloc GmbH & Co KG (www.sigcombibloc.com) and Bericap GmbH & Co (www.bericap.com).

Technical Problems

All of these fitments suffer from technical problems including the amount of force needed to open the package and the relative complexity of manufacture, installation and use, particularly for fitments assembled from multiple parts. Alignment issues are a particular problem in post-applied fitments. Since the fitments need to be glued onto the containers there is a risk that they will become detached in transit. The external application also makes these closures vulnerable to tampering. Use of these closures is frequently not intuitive creating additional problems of consumer education.

Solution of the Invention

Rather than the approach of these prior art fitments, which retain the barrier layer in the composite paperboard carton, the present invention solves the problem of providing a continuous barrier layer with a resealable pour spout closure by providing the barrier layer within the closure itself so that it can be inserted into a pre-cut hole as with non-aseptic cartons.

However in an aseptic/ESL context, it is not acceptable to expose bare aluminium to the contents of many aseptically packaged fluids, for example high acid products. This is because such products have a propensity - over the long shelf life of six to nine months- to oxidise the metal. Therefore any bare foil must be prevented from coming into contact with the contents of the aseptic carton. It is therefore not sufficient to apply a foil – even a coated foil - to a base flange of a carton fitment, as any exposed cut edge would be vulnerable to this oxidation over time. It is known to avoid such contact in the structural seams needed to make a carton from a composite paperboard

blank. Typically to create such seams, an inner paperboard layer is folded outwardly and overlapped with an outer layer so that the edges of the barrier layer foil are prevented from coming into contact with the contents. The seam is welded by ultrasound or induction heat sealed. This is found to produce acceptable results.

Applying a removable, peelable foil seal across a top of a fitment spout prevents the presence of a plug inside the overcap for satisfactory reseal and leaves a significant breach in the gas barrier through the base flange surrounding the spout within the hole and the spout wall.

It is therefore preferable to continue the barrier layer in the base flange of the fitment and this is a solution described in US4,948,015 (Kawajiri). The fitment described has a base flange provided with a recess into which a thin film having a property of a gas barrier is securely fitted. It is suggested that the film may be of laminated structure comprising polyethylene, aluminium and polyethylene layers. The barrier layer has its peripheral edge concealed by the material of the film. Insert moulding is suggested as a technique for joining the film to the fitment. In principle the Kawajiri proposal solves the technical problems discussed above. However the design is not practicable for the following reasons:

- Practical, high volume, low cost manufacture of multilayer films containing an entirely embedded aluminium foil layer (with no exposed aluminium edge) is not known in the art and no method is described by Kawajiri..

- Insert moulding for such lightweight foil discs would be a slow procedure requiring careful placement of discs into the mould.

- In order to place the disc into the recess it is almost inevitable that a crevice would be created within the recess around the disc and this would render the fitment unsuitable for aseptic use as the crevice could not be adequately sterilised prior to use. The inability to kill bacteria hiding in crevices is a major issue that leads to any packaging subject to this problem being non aseptic, leading to a product "shelf life" of a few days, rather than the current aseptic norm of many months

shelf life under non refridgerated conditions.

In accordance with the present invention the technical problems left unsolved by Kawajiri are solved by providing a fitment comprising a base flange and a hollow spout, a removable part within a base of the spout, and an overcap for resealably closing the spout, and a barrier foil coated on both sides with a plastics layer extending across the base flange, characterised in that the foil has an exposed cut edge prior to assembly in the fitment and that edge of the foil is assembled to the flange in such a manner that the edge is prevented in use from coming into contact with contents of a container to which the fitment is assembled. The edge can be sealed away in various ways such as, for example, by embedding it into the plastic of the flange, folding it underneath prior to sealing to the flange, or wrapping it around a peripheral edge of the flange.

Preferably the edge of the foil is embedded in the base flange. By embedding the edge of the foil into the plastic it cannot taint the product. Since the barrier layer in the paperboard carton overlaps with the barrier foil applied to the base flange there is no break in the barrier layer.

Such a fitment can be manufactured by a method comprising the steps of placing a foil having a plastics layer on each surface within a receiving wall projecting from a first surface of a base flange of a fitment that has a hollow spout extending from an opposite surface, and securing the foil to the flange such that the wall is sealed over the edge of the foil disc.

The fully assembled fitment may be inserted into a pre-cut hole in a composite paperboard carton blank from inside prior to filling and the embedding of the foil edge carried out as part of the same process as welding the flange to the paperboard.

Alternatively the present invention provides a fitment comprising a base flange having a first surface and a hollow spout projecting from a surface opposite the first surface, a removable part within a base of the spout, and an overcap for resealably closing the spout, characterised in that a barrier foil coated on both sides with a plastics layer is

wrapped over the first surface of the flange such that the foil extends onto the opposite surface surrounding the spout.

In this alternative construction the cut edge of the foil is prevented from coming into contact with the contents of the container as it is sealed to a paperboard wall during the ultrasound welding of the fitment into the carton. This seal has exactly the same construction and integrity as other seals elsewhere on the paperboard carton. The barrier layer in this construction is virtually continuous as there are only the inner polyethylene layers between the two foils and not even the modest thickness of the base flange as in the earlier variation.

Preferably the fitments as claimed are used in any shape of paperboard carton, but it will be appreciated that this type of fitment could also be applied to a mouth of a gas impervious bottle such as a barrier PET or multi-layer polyolefin bottle; to a coated steel or aluminium can or can lid; or to a mono or multi-layer plastics container which is thermoformed, injection moulded or blow moulded.

Brief Description of the Drawings

In order that the invention may be well understood some embodiments thereof will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:

Figure 1 shows a longitudinal section through a fitment in accordance with a first embodiment of the invention assembled in a carton top;

Figure 2 shows a detail of an edge of the base flange of Figure 1 prior to insertion of a foil;

Figure 3A shows a detail of an alternative embodiment of the edge of a base flange prior to insertion of a foil;

Figure 3B shows a detail of an edge of the base flange of Figure 3A after insertion of the foil and before an induction heat sealing step;

Figure 4 shows a section through a fitment in accordance with a further embodiment of the invention; and

Figure 5 shows a section through a fitment in accordance with a yet further embodiment of the invention.

Overview

A carton fitment 2 is made up of a base flange 4 with an upstanding pour spout 6, which is closed by an overcap 8.

The fitment 2 is two injection moulded plastics components.

The spout 6 comprises a hollow cylindrical spout in the base of which there is a removable part 10. The removable part 10 is a plastics disc joined to the remainder of the base flange 4 by a weakened section 12. A ring pull 14 is connected to the removable part 10 in order to allow the removable part to be removed.

As so far described, this fitment is substantially similar to carton fitments known in the art for use with standard paperboard cartons. Any of the design features employed on such fitments can be incorporated into the fitment of the present invention.

The fitment of the present invention is however intended to be used with a container providing a barrier layer. As illustrated in Figure 1 the fitment is inserted into a pre-cut hole 20 in a composite paperboard carton wall 22. The fitment 2 could also be assembled to an open mouth of a barrier PET or polyolefin barrier layer bottle; or any other gas tight container, such as a tin can made up of mono or multi layers including aluminium, steel etc coated with a plastics surface layer, or a plastics container, which is thermoformed, injection moulded or blow moulded, whether by an extrusion or injection-stretch blow moulding process.

A foil disc 30 is sealed to an underside of the base flange 4 and removable part 10.

Instead of a solid disc, the removable part 10 could be constructed as an annular frame typically with a central, three-pointed star structure. Such a frame would be joined by

weekened bridges to the base flange 4. This reduces the overall weight of the fitment 2.

The foil disc 30 is cut from an aluminium foil, which is coated on both sides with a plastics layer, typically polyethylene, polypropylene or PET, which enables it to be bonded to other plastics components.

The base flange 4 is welded in an annular region A to the carton wall 22 by means of induction heat sealing or ultrasonic welding. A receiving wall 32 surrounds a peripheral edge of the base flange 4. In Figure 1 the receiving wall 32 is shown as having been deformed inwardly over the peripheral edge of the foil disc 30 in order to prevent the contents of the container being exposed to an edge of the aluminium layer within the double sided coated foil disc 30.

Carton Structure

The composite paperboard carton 22 is formed from several layers of material including a gas barrier layer 40. This barrier layer may be aluminium foil or EVOH or any other suitable material. The barrier layer is bonded by means of an adhesive layer to a paperboard layer which is coated on each side by a polyethylene coating. Other detailed constructions of the composite paperboard are possible.

Closure Construction

One possible construction for the overcap and pour spout is described in WO99/61337 (Spreckelsen McGeough), which also shows how a foil may be fitted into a base flange. However, in that document, the free metal edge of the foil would be exposed. Spreckelsen McGeough also shows a snap on overcap. It will be appreciated that the screw on overcap 8 as illustrated is equally appropriate for closing the pour spout 6. The overcap 8 is shown as having a plug 42, which is received within an open mouth of the spout 6 in order to ensure effective resealing. Threads 44, 46 are formed on the external wall of the spout of the pour spout 6 and on a facing internal wall of the overcap 8 in order to enable the overcap to be screwed onto the spout of the spout.

Sealing the Edge of the Foil

An essential feature of the fitment of the present invention is that the metal edge of the foil is prevented from coming into contact with the contents of a container in use when the fitment is assembled. The fitment 2 is preferably pre sealed to the foil 30 before installation in the container. In the embodiment of Figures 1 and 2 the foil disc 30 is seated within a receiving wall 32 which, prior to assembly of the foil to the spout 6, depends vertically from the base flange 4 as shown in Figure 2. During assembly a tool is used to press the receiving wall 32 over the edge of the foil disc during an induction heat sealing process. The receiving wall 32 is therefore a sacrificial part of the spout construction and the plastic making up this material effectively melts over the edge of the foil to seal in the exposed metal edge.

An alternative construction of the receiving wall 32 is shown in Figures 3A and 3B. In this arrangement the wall 32 has a weaked portion 50 in an intermediate annular region. Once the foil disc 30 is inserted within the receiving wall 32 the weakened portion 50 allows a terminal end 52 of the wall to be deformed inwardly over the edge of the foil to retain it in position to ensure that the plastic of this sacrificial receiving wall 52 flows over and covers any exposed metal edge.

An alternative approach to sealing away the metal edge of the foil 30 is shown in Figure 4. In this embodiment the foil 30 is larger than the diameter of the base flange and is wrapped over the entirety of a lower first surface 54 of the base flange 4 around a free edge and onto a second surface 56 of the base flange. The folded edge terminates inwardly of the annular region A at which the base flange 4 is welded to the container 22.

In the embodiment of Figure 5 the foil disc 30 has its edges folded upwardly and inwardly prior to being welded to the base flange 4. This folding step may be done by means of an appropriate forming tool during placement of the foils on the base flange 4. A periphery of the base flange 4 is provided with a retaining wall 34 to retain the folded foil disc in place prior to sealing.

Method of Manufacturing

The carton fitments 2 are preassembled to the foil disc 30 and the foil welded in position by an induction heat sealing process before the fitments are assembled to the paperboard carton. The assembly to the paperboard carton is as with standard non-aseptic packaging and will not be described in detail here. As an alternative to induction heat sealing of the foil to the base flange 4, ultrasonic welding may be employed. The foil may also be secured to the flange by adhesive means. In the embodiment of Figure 4, it is possible to rely on the wrapping over of the outer peripheral edge of the foil around the base flange 4 to secure the foil to the spout 6. Although further bonding steps can be undertaken prior to installation in the carton, these are not essential with this embodiment. If the fitment 2 is induction heat sealed to the carton the foil 30 will weld to the base flange at that time.

In the embodiment of Figure 4 the seal which is created between the edge of the foil 30 and the wall 22 is of exactly the same construction as on the other seams elsewhere in a paperboard carton of this type.

Continuity of the Barrier Layer

Once the fitment 2 is welded into hole 20 in the paperboard carton wall 22 the barrier layer constituted by the foil 30 creates a continuous barrier layer with the layer 40 within the paperboard carton. Therefore, the ease of assembly advantages of the carton fitments used with non-aseptic packaging are combined with the integrity of the barrier layer offered by post applied prior art fitments traditionally used with aseptic packaging.

Consumer Use

In use, a consumer can open the packaging by removing the overcap 8 by unscrewing it in order to gain access to the ring pull 14. The removable part 10 can then be removed by use of the ring pull 14. Since the foil 30 is welded to the whole of the base flange 4 including the removable part 10, the pulling out of the ring pull will breach the foil and allow access to the container contents. If necessary, teeth may be formed in the lower surface 54 of the base flange 4 in order to facilitate tearing of the

foil as described in Spreckelsen McGeough above. If the foil is not severed by removal of the removable part 10, it is relatively easy for this foil layer to be punctured manually.

Although a ring pull has been shown, any of the other prior art mechanisms can be used in the spout to remove the removable part and breach the foil to allow access to the contents.